



# The Relationship Between Malnutrition, Depressive Symptoms, and Cognitive Impairment in Geriatric Patients

## Geriatrik Hastalarda Malnütrisyon, Depresif Belirtiler Ve Bilişsel Bozulma Arasındaki İlişki

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### Abstract

**Aim:** Malnutrition is an important health problem that is frequently seen in elderly individuals and has cognitive and psychological effects. In this study, it was aimed to evaluate the frequencies of malnutrition, cognitive impairment and depression in the elderly population and the relationship between these three variables.

**Material and Methods:** In this retrospective study, data of 433 patients aged 65 and over who applied to a university hospital geriatrics outpatient clinic in Turkey were included. Nutritional status was evaluated with the Mini Nutritional Assessment Short Form (MNA-SF), depressive symptoms with the Geriatric Depression Scale-Short Form (GDS-15) and cognitive functions with the Mini Mental State Examination results (MMSE).

**Results:** According to the MNA-SF results, 13.6% of the elderly were malnourished, 30% were at risk of malnutrition. Of all patients, 45.0% had a GDS-15 score of  $\geq 5$ , 12.5% had severe dementia, and 24.7% had mild dementia. The frequency of depressive symptoms was 62.7% in malnourished patients, and 42.3% in those with malnutrition risk. Malnutrition and malnutrition risk were observed in 70.4% of patients diagnosed with severe dementia. There was a correlation between the severity of malnutrition and depressive symptoms and cognitive dysfunction.

**Conclusion:** Malnutrition was common in the older population sample and was associated with cognitive impairment and depressive symptoms. These findings emphasize that counseling and psychiatry services should be provided to risky groups and they should be evaluated regularly for early diagnosis.

**Keywords:** Elderly, nutritional status, cognitive impairment, depression

### Öz

**Amaç:** Beslenme bozukluğu, yaşlı bireylerde sık görülen, bilişsel ve psikolojik etkileri olan önemli bir sağlık sorunudur. Bu çalışma yaşlı popülasyonda yeme bozukluğu, bilişsel bozukluk ve depresyon yaygınlığı ile bu üç değişken arasındaki ilişkiyi değerlendirmeyi amaçlamıştır.

**Materyal ve Metod:** Retrospektif nitelikteki bu çalışmaya Türkiye'de bir üniversite hastanesi geriatri polikliniğine başvuran 65 yaş ve üstü 433 hastaya ait veriler dahil edildi. Beslenme düzeyleri Mini Nutrisyon Testi Kısa Formu (MNA-SF), depresif semptomlar Geriatrik Depresyon Skalası-Kısa Form (GDS-15) ve bilişsel fonksiyonlar Mini Mental Durum Değerlendirme Test (MMSE) sonuçlarıyla değerlendirildi.

**Bulgular:** MNA-SF sonuçlarına göre yaşlıların %13.6'sı malnutre, %30'u malnütrisyon riski altındaydı. Hastaların %45'inin GDS-15 puanı  $\geq 5$  iken, %12.5'inde ciddi demans, %24.7'sinde hafif demans vardı. Malnütrisyonlu hastalarda depresif belirtilerin sıklığı %62.7, malnütrisyon riski olanlarda %42.3 idi. Demans teşhisi alan hastaların %70.4'ünde malnütrisyon ve malnütrisyon riski görüldü. MNA-SF puanı ile depresif belirtiler ve bilişsel fonksiyonlar arasında ilişki vardı.

**Sonuç:** Yaşlı popülasyon örneğinde malnütrisyon yaygındı ve bilişsel bozulma ve depresyon ile ilişkiliydi. Bu bulgular, riskli gruplara danışmanlık ve psikiyatri hizmetlerinin verilmesi, erken teşhis için düzenli olarak değerlendirilmesi gerektiğini vurgulamaktadır.

**Anahtar Kelimeler:** Yaşlı, beslenme durumu, bilişsel bozulma, depresyon

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## INTRODUCTION

Starting from the early stages of life, a balanced diet, maintaining a healthy body weight and a physically active lifestyle are the main effective factors that help individuals avoid physical and mental deterioration associated with aging (1,2).

On the other hand, aging brings with it many physiological and psychological changes that may make it difficult to meet nutritional needs (3,4). The prevalence of malnutrition is generally high in older adults. A meta-analysis study examining 4507 elderly individuals reported that approximately two-thirds of its participants were undernourished and at risk of malnutrition (5). Another study in Canada in a population of older adults concluded that one-third of the participants were at nutritional risk. Moreover, it has been reported that these individuals at risk have a 20% higher probability of requiring acute hospital care and a 60% higher mortality rate (6). Therefore, adequate nutrition is one of the requirements of independent living and malnutrition is an important factor affecting mortality and morbidity (7-9).

Depression and cognitive disorders are important public health problems in the elderly and are closely related to malnutrition (10,11). Although studies cannot provide a definite causality regarding this relationship, it is thought that malnutrition disrupts the functions of a series of immune, neurohumoral and neurotransmitter systems by causing a deficiency of essential molecules that play a role in the execution of brain functions. Depression creates reluctance, physical weakness, and loss of appetite; dementia on the other hand may lead to malnutrition due to reasons such as not feeling hungry as a result of brain atrophy, eating behavior disorder, and difficulty in swallowing (12-15). As a result, all these changes affect each other negatively and bring along many problems such as a decrease in life expectancy, the need for care from others, and an increase in the burden on health services (8).

Although malnutrition is common especially in the geriatric population and its proven impact on morbidity and mortality rates is known, it is still a neglected issue by many clinicians. However, considering that the number of individuals over the age of 60 will double in the next 20 years (16), it is necessary to examine this issue and to determine the necessary precautions for public health. In the light of this information, we aimed to determine the nutritional status, depression and cognitive impairment levels of a group of elderly population and to evaluate the possible relationship between these three variables in this study.

## MATERIAL AND METHOD

### Participants and Study Protocol

The study was carried out by retrospectively examining the medical files of the patients who applied to the geriatric's outpatient clinic of Inonu University. The files were reviewed

by the researchers; the Geriatric Depression Scale-Short Form (GDS-15), Mini Nutritional Assessment Short Form (MNA-SF) and Mini Mental State Examination (MMSE) results and gender, education (uneducated, primary-high school-university), marital status, living environment (alone, with spouse, relatives, caregiver, nursing home), smoking and alcohol use, number of drugs used, comorbid diseases, body mass index (BMI), waist circumference, calf circumference, upper middle arm circumference, albumin and C-reactive protein (CRP) values were recorded. Data of patients who lacked comprehensive geriatric tests were excluded from the study.

It was evaluated and approved by the Inonu University Faculty of Medicine Non-Invasive Ethics Committee beforehand. (2022/2989).

### Sample size

For the Geriatric Depression Scale-Short Form total score value, which is one of the important output variables to be examined within the scope of the study, Type I error amount ( $\alpha$ ) is 0.05, test power (1- $\beta$ ) is 0.9, effect size is 0.5, and alternative hypothesis ( $H_1$ ) is two-sided and the required minimum sample size was calculated as 40 patients, according to the theoretical power analysis procedure applied using the single sample t-test (17).

### Data Collection Tools

**Mini Nutritional Assessment Short Form (MNA-SF):** It is a screening test used to identify older adults (> 65 years) who are malnourished or at risk of malnutrition. The MNA-SF is based on the original 18-item questionnaire published in 1994 by Guigoz et al. The MNA-SF was last updated in 2009 (18). Its validity and reliability in Turkey were done by Sarikaya et al in 2013 (19). MNA-SF starts with six screening questions and the total score to be obtained from the scale is 14. A total score of 12-14 indicates normal nutritional status, 8-11 indicates malnutrition risk, and 0-7 indicates malnutrition.

**Geriatric Depression Scale-Short Form (GDS-15):** The scale was developed by Sheikh and Yesavage in 1986 to screen depression in elderly patients (20). The validity and reliability of the 15-item test in Turkey was determined by Durmaz et al. by in 2018 (21). The total score to be taken from the scale is 15. A score of five or more is considered compatible with depression.

### Mini Mental State Examination (MMSE)

The MMSE is a simple screening test that is used to evaluate cognitive functions and it takes approximately 3 minutes to administer (22). Its validity and reliability in Turkey were tested in 2002, and a threshold value of 24 was found to be sensitive and specific (23). A score of

24-30 is normal, a score of 18-23 is compatible with mild dementia, and a score of 17 and below is compatible with severe dementia (24).

### Statistical analysis

The data were analyzed after transferring the SPSS 22.0 package program. Whether the data were normally distributed or not was evaluated with the Shapiro-Wilk test. Non-parametric Kruskal-Wallis test, and ANOVA, which is the parametric test, was applied to the others. Spearman and Pearson correlation tests were used according to distributions for number of medications, age, MNA-SF, GDS-15 and MMSE scores. The results were evaluated at 95% confidence interval and  $p < 0.05$  significance level.

## RESULTS

A total of 433 patients, 161 (mean age  $72.3 \pm 6.9$ ) male and 272 (mean age  $71.8 \pm 7.0$ ) female were included in the study. Of the participants, 31.4% were illiterate and most of them lived with their spouses (51%). Demographic and clinical data of the participants are given in Table 1.

In the nutritional evaluation made according to MNA-SF scores, it was determined that 59 (13.6%) of the patients had malnutrition and 130 (30%) had a risk of malnutrition. In the comparison between nutritional status and demographic characteristics, there was a statistically significant difference between the groups in terms of living environment and marital status ( $p = 0.024$ ,  $p = 0.038$ ,

respectively) (Table 2).

In the comparison between nutritional status and anthropometric measurements; While the GDS-15 score of the malnourished group was significantly higher than the other two groups ( $p < 0.001$ ), BMI, hip and upper middle arm circumference measurements and the MMSE score of them were significantly lower in the malnourished group compared to the other groups ( $p < 0.001$ ,  $p = 0.002$ ,  $p < 0.010$ ;  $p < 0.001$ ; respectively) (Table 3).

When all patients were evaluated, depression was detected in 195 (45.0%) patients, 146 of whom were women, severe dementia in 54 (12.5%) patients and mild dementia was detected in 107 (24.7%) patients. While there was depression in 62.7% ( $n = 37$ ) of 59 patients with malnutrition according to nutritional status, this rate was 42.3% ( $n = 55$ ) in those with malnutrition risk. Malnutrition and malnutrition risk were detected in 38 (70.4%) of 54 patients with severe dementia and 40 (37.4%) of 107 patients with mild dementia. In the correlation analysis between nutritional status and the number of drugs used, age, anthropometric measurements, MMSE and GDS-15: There was a negative correlation between MNA-SF score and age and GDS-15 scores, while a positive correlation was found between MMSE scores. There was a negative correlation between GDS-15 scores and MMSE scores, and a positive correlation with the number of medications used (Table 4).

**Table 1. Demographic and clinical data of the patients (n=433)**

		n	%
Age (year) mean $\pm$ SD		72.02 $\pm$ 6.97	
Gender	Male	161	37.2
	Female	272	62.8
Education status	Illiterate	135	31.3
	Primary school	194	44.8
	Middle School	53	12.2
	High School	20	4.4
	University	31	7.3
Marital status	Married	300	69.3
	Single	55	12.7
	Widowed	70	16.2
	Divorced	8	1.8
Domestic status	Alone	35	8.1
	Living with spouse	221	51.0
	With relatives	133	30.7
	With a caregiver	42	9.7
	Nursing home	2	0.5
Number of medications	1-4	294	67.9
	5-9	125	28.9
	$\geq 10$	14	3.2
Smoking history	Yes	67	15.5
	No	366	84.5
History of alcohol use	Yes	15	3.5
	No	418	96.5

**Table 2. Nutritional status and demographic characteristics**

		Nutritional Status			
		Malnutrition n (%)	Malnutrition Risk n (%)	Normal n (%)	p
		59 (13.6)	130 (30.0)	244 (56.4)	
<b>Gender</b>	Female	18 (4.2)	52 (12.0)	91 (21.0)	0.457
	Male	41 (9.5)	78 (18.0)	153 (35.3)	
<b>Education status</b>	Illiterate	12 (8.9)	37 (27.4)	86 (63.7)	0.070
	Primary school	32 (16.5)	61 (31.4)	101 (52.1)	
	Middle school	12 (22.6)	11 (20.8)	30 (56.6)	
	High School	1 (5.3)	7 (36.8)	11 (57.9)	
	University	2 (6.5)	13(41.9)	16 (51.6)	
<b>Marital status</b>	Married	35 (11.7)	90 (30.0)	175 (58.3)	0.038 <sup>#</sup>
	Single	16 (29.1)	14 (25.5)	25 (45.5)	
	Widowed	7 (10.0)	23 (32.9)	40 (57.1)	
	Divorced	1 (12.5)	3 (37.5)	4 (50.0)	
<b>Domestic status</b>	Alone	3 (8.6)	11 (31.4)	21 (60.0)	0.024 <sup>†</sup>
	Living with spouse	19 (8.69)	64 (29.0)	138 (62.4)	
	With relatives	26 (19.5)	42 (31.6)	65 (48.9)	
	With a caregiver	11 (26.2)	12 (28.6)	19 (45.2)	
<b>Smoking</b>	Nursing home	0 (0.0)	1 (50.0)	1 (50.0)	
	Yes	10 (14.9)	18 (26.9)	39 (58.2)	0.815
No	49 (13.4)	112 (30.6)	205 (56.0)		
<b>Alcohol</b>	Yes	1 (6.7)	4 (26.7)	10 (66.7)	0.636
	No	58 (13.9)	126 (30.1)	234 (56.0)	
<b>Depression</b>	Yes	37 (19.5)	55 (28.9)	103 (51.6)	<0.001 <sup>†</sup>
	No	22 (9.0)	75 (30.9)	141 (60.1)	
<b>Dementia</b>	Mild	13 (3)	27 (6.2)	67(15.5)	0.002 <sup>§</sup>
	Serious	20 (4.6)	18 (4.2)	16 (3.7)	

<sup>#</sup> Statistically significant difference between Malnutrition vs. Normal

<sup>§</sup> Statistically significant difference between Malnutrition Risk vs. Normal

<sup>†</sup> Statistically significant difference between Malnutrition vs. Malnutrition Risk; Malnutrition vs. Normal

**Table 3. Comparison of nutritional status and anthropometric values, GDS-15 and MMSE scores**

		Nutritional Status			
		Malnutrition (n=59)	Malnutrition Risk (n=130)	Normal (n=244)	p
Calf circumference (cm) <sup>a</sup>		40.54±10.62	41.38±11.57	40.25± 11.17	0.660
BMI (kg/m <sup>2</sup> ) <sup>a</sup>		26.50±5.93	29.36±8.94	30.71± 5.68	<0.001 <sup>†</sup>
Hip circumference (cm) <sup>a</sup>		103.16±14.82	105.37±20.21	111.06± 18.04	0.002 <sup>†</sup>
Upper middle arm circumference (cm) <sup>a</sup>		28.88±4.10	29.70±4.83	30.69± 4.18	0.010 <sup>#</sup>
Number of medications		2 (0-8)	4 (0-13)	3 (0-13)	0.068
CRP <sup>b</sup>		2.1 (0.2-7.6)	3.6 (0.4-10.3)	3.6 (0.2-10.8)	0.185
Albumin <sup>b</sup>		3.82±0.31	3.88± 0.42	3.98± 0.61	0.771
GDS-15 <sup>b</sup>		6 (1-15)	6 (0-15)	7 (0-15)	<0.001 <sup>§</sup>
MMSE <sup>b</sup>		24 (10-30)	25 (10-30)	26 (12-30)	<0.001 <sup>†</sup>

Data are presented as mean ± SD.

BMI: Body mass index, CRP : C-reactive protein, MMSE: Mini Mental State Examination, GDS-15: Geriatric Depression Scale

<sup>a</sup>Data are presented as Mean±SD. <sup>b</sup> Data are presented as median (min-max)

<sup>#</sup> Statistically significant difference between Malnutrition vs. Normal

<sup>§</sup> Statistically significant difference between Malnutrition Risk vs. Normal

<sup>†</sup> Statistically significant difference between Malnutrition vs. Malnutrition Risk; Malnutrition vs. Normal;

<sup>‡</sup> Statistically significant difference between Malnutrition vs. Malnutrition Risk; Malnutrition vs. Normal; Malnutrition Risk vs. Normal

**Table 4. Correlation analysis results between age, MMSE, GDS-15, and MNA-SF scores**

		Correlations			
		Age	MMSE	GDS-15	MNA-SF
Age	r	1	-0.256**	0.008	-0.182**
	p		0.000	0.871	0.000
Number of medications	r		0.004	0.097*	0.015
	p		0.927	0.044*	0.762
MMSE	r		1	-0.165**	0.156**
	p			0.001	0.002
GDS-15	r			1	-0.211**
	p				0.000
MNA-SF	r				1
	p				

Only significant values are shown in the table. \* $p < 0.05$ , \*\* $p < 0.01$ . MMSE; Mini Mental State Examination, GDS-15; Geriatric Depression Scale, MNA-SF; Mini Nutritional Assessment-Short Form

## DISCUSSION

Although dietary changes are not a natural component of aging, older adults are at risk for malnutrition due to physiological, psychological, social and environmental factors. This study investigated the relationship between the malnutrition and depressive symptoms and cognitive functions in geriatric patients.

A meta-analysis study evaluating the data of 12 countries showed that 22.8% of the entire geriatric population is severely malnourished, and 46.2% is within the risk limits, although it differs from country to country (5). The study by Mantzorou et al. on elderly individuals in Greece showed that 11.3% of 2092 individuals were malnourished and 35% were at risk (9). Gunduz et al. also found that 196 (19%) of 1030 geriatric patients had malnutrition and 300 (29.1%) had a risk of malnutrition (25). Our study was also compatible with previous studies, the frequency of individuals with malnutrition was found to be 13.6%, and the frequency of those with malnutrition risk was found to be 30%.

Previous studies (9,26) have shown that nutritional status declines with increasing age. Our study also confirmed this relationship and showed a positive relationship between age and malnutrition. In addition, it was determined that marital status and living environment pose a risk for malnutrition, and this rate is higher especially in singles and those who have to live with their caregivers for certain reasons.

Considering that appetite is strongly affected by the environment and mood, and the psychological and social

changes that may occur with aging (27), this result was remarkable in that it showed that being dependent on others as well as being alone can pose a risk in terms of malnutrition.

Depression is a common condition in the elderly population and is associated with morbidity. A meta-analysis study reported that depressive complaints are common in elderly individuals (28). Our study supported these studies, which showed that depression was common in elderly patients (45%) and that women were especially at higher risk.

It has been reported that there is a positive correlation between depression and malnutrition in elderly individuals (30). Similarly, in this study, the malnutrition and malnutrition risk group had higher depressive symptom scores than the adequate nutritional status group, and a positive correlation was found between malnutrition severity and depressive symptoms. Although the causal relationship between depression and nutrition is not certain, malnutrition is accepted as one of the predictors of depression in elderly patients (31). A cohort study conducted in the USA found that depression was associated with weight gain in individuals younger than 50 years of age, while it led to weight loss at later ages (32). Therefore, this result may be related to the decrease in appetite accompanying depression (33), and it can be interpreted that the lack of essential nutrients in the body of malnourished patients activates some mechanisms that will lead to the development of depression (34). In this case, cognitive functions are also expected to be affected, and the positive relationship we found between depressive symptoms and cognitive impairment supported our judgment. Indeed, studies have argued that depression may be a risk factor for dementia and depressive symptoms may be observed during the development of cognitive impairment (35). In addition, existing depression is defined as a prognostic factor for the rapid progression of mild cognitive impairment (36). Therefore, early detection and treatment of malnutrition is vital for independent living.

In this study, according to the MMSE score, 12.5% of the elderly participants had severe cognitive impairment and 24.7% had mild cognitive impairment. The ratios obtained were higher than Mantzorou et al.'s study which reported that 18.2% of the population had mild, 13.6% moderate, and 2.7% severe cognitive impairment (9), and Plasman et al's sample study which reported the mild cognitive impairment rate as 22.2% (37). From this perspective, this study showed a relatively high prevalence of cognitive impairment in Turkish elderly people and pointed to a serious public health problem. In addition, our study showed a positive relationship between increased severity of malnutrition and cognitive impairment, and this result was consistent with studies showing that malnutrition is a prognostic factor for cognitive decline (38-40).

In our anthropometric analyzes, it was seen that BMI and upper middle arm and hip circumference measurements could be used in the evaluation of malnutrition. In the study of Gündüz et al., BMI was also found to be independently

associated with malnutrition (25). In fact, although it is known that BMI, arm and calf circumference measurements will be used in the evaluation of malnutrition (41), there was no difference in calf circumference results between the groups in this study. If this result is attributed to the physical differences between the populations and the disruptions in the standardization of the measurements, it was important in terms of revealing the necessity of considering all of the anthropometric measurements in the general evaluation.

Another correlation obtained in the study was that depressive symptom scores increased as the number of medications increased. Although the types of medicine used in our study were not evaluated, it is possible that some of the medicine used produced depressive effects. On the other hand, the use of multiple drugs may reflect more comorbidity, and increased comorbidity may impair mental health by creating biological, sociological and psychological problems.

There are some limitations of our study. First and perhaps most important of these, the rate of diagnosis of dementia and depression may have been found to be high, since the study was conducted in the geriatrics outpatient clinic in a tertiary health institution. Therefore, the results obtained may not reflect the entire population. The retrospective design of the study prevented the investigation of some social factors (economic status, family relationships, bereavement/grief status, and social stressors) that may affect the results. Prospective and multicenter studies in the future may correct these limitations. On the other hand, it had sufficient sample size and validated scales were used to measure cognitive functions and depressive symptoms. These data could add to the small but growing literature on nutrition, aging and health in Turkey.

## CONCLUSION

In conclusion, malnutrition is common in older adults, and increasing age and living with a caregiver pose a risk for malnutrition. In addition, there is a relationship between cognitive dysfunction and depressive symptoms and malnutrition. Therefore, simple questionnaires and measurements used during routine outpatient controls of geriatric patients can detect the risk of malnutrition and provide guidance to clinicians in taking measures that will contribute to the improvement of mortality and morbidity of elderly patients by evaluating their cognitive and psychological status.

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**Conflict of Interest:** *The authors declare that they have no competing interest.*

**Ethical approval:** *It was evaluated and approved by the Inonu University Faculty of Medicine Non-Invasive Ethics Committee beforehand (2022/2989).*

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